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(54) **Sheet overlapping detecting method.**

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**EP-A- 0 103 153**
**EP-A- 0 149 699**
**EP-A- 0 342 647**
**FR-A- 2 492 349**
**US-A- 4 395 127**
**US-A- 4 605 926**

**PATENT ABSTRACTS OF JAPAN, vol. 10, no. 26 (P-425)[2083], 31st January 1986;& JP-A-60 177 206 (KOMORI INSATSU KIKAI K.K.) 11-09-1985**

**PATENT ABSTRACTS OF JAPAN, vol. 10, no. 211 (M-501)[2267], 4th July 1986;& JP-A-61 51 444 (TOKYO KUKO KEIKI K.K.) 03-03-1986**

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## Description

### Background of the Invention

The present invention relates to a sheet overlapping detecting method for use in particularly a sheet-fed press.

Conventionally, when sheets (sheets of paper) are to be fed to a sheet-fed press, overlapping of the sheets of paper to be fed is detected.

That is, when a sheet of paper is to be fed from a feeding apparatus to a sheet-fed press (to be referred to as simply a press hereinafter), the leading edge of the sheet of paper is brought into contact with a stopper called a front guide provided at the press-side distal end portion of a feeding table, and then the sheet of paper is fed to the press. In this case, in order to prevent two or more overlapped sheets of paper from being simultaneously fed, a light-emitting device is arranged at the rear surface side of the feeding table in a position close to the front guide, and a through hole is formed in a predetermined portion of the feeding table corresponding to a light-emitting portion of the light-emitting device. In addition, a light-receiving device is arranged at the upper surface side of the feeding table corresponding to the through hole. That is, light emitted from the light-mitting device is radiated in the direction of thickness of a sheet of paper to be fed, and transmission light transmitted through the sheet of paper is received by the light-receiving device and converted into an electrical signal to obtain a received light amount. An output level corresponding to the received light amount is compared with a predetermined determination level, and overlapping of sheets of paper is detected on the basis of the comparison result.

In this case, a light emission amount of light emitted from the light-emitting device and the determination level are preferably set to be optimum values for a corresponding sheet of paper. That is, the relationship between the light emission amount and the output level obtained when the number of sheets of paper is one is different from that obtained when the the number of sheets of paper is two. For example, as shown in Fig. 5, a characteristic curve I is obtained for one sheet of paper, and a characteristic curve II is obtained for two sheets of paper. In this case, the optimum value of the light emission amount is a light emission amount value at which a difference between output levels based on the characteristic curves I and II becomes maximum. The optimum value of the determination level is 1/2 a sum of the output levels based on the characteristic curves I and II obtained at the optimum light emission amount value.

According to a first conventional method, a pr determined det rmination l vel is set, and power supply to the light-emitting device is adjusted such that the determination level is positioned at a substantially intermediate point between an output level obtained via the light-receiving device when the number of sheets of paper is one and an output level obtained when the number of sheets of paper is two, thereby setting a light emission amount of light to be emitted from the light-emitting device. The reference EP-A-0 342 647, which falls under Article 54(3) describes such a method; several output values are taken and the mean of these values is compared with the predetermined reference level. The light emitter intensity is adjusted such that the mean output level stays within a predetermined range of the reference level. According to a second conventional method as described in the document EP-A-0 149 699 for example, predetermined power supply to the light-emitting device is set to determine a light emission amount of light to be emitted from the light-emitting device, and a determination level is set to be positioned at a substantially intermediate point between an output level obtained via the light-receiving device when the number of sheets of paper is one and an output level obtained when the number of sheets of paper is two.

In general, however, a small number of lots of a material is often printed by a press using various types of sheets of paper. That is, since the characteristic curves I and II shown in Fig. 5 change in accordance with the paper quality (including paper thickness, a color, and the like) of paper to be used, the optimum values of a light emission amount and a determination level cannot be kept constant. Therefore, in the above first and second methods, it is difficult to perform stable overlapping detection with high precision for sheets of paper having a wide range of paper quality In addition, adjustment of the optimum values undesirably largely depends on the skills of an operator.

### Summary of the Invention

It is, therefore, an object of the present invention to provide a sheet overlapping detecting method which can perform stable overlapping detection of sheets with high precision and can perform adjustment without depending on the skills of an operator.

Accordingly, in a sheet overlapping detecting method in which light-emitting means is driven in accordance with a light emission signal having a control level $V_{out}$ output from a data processing unit, light emitted from the light-emitting means is radiated in a direction of thickn ss of a sheet to be fed, light transmitted through the sheet to be fed is

received by light-receiving means, a light reception signal having an output lev l $V_{in}$ corr sponding to a received light amount of the light-receiving means is input to the data processing unit, and overlapping of sheets to be fed is detected on the basis of the light reception signal, comprising the step of setting a predetermined level value $V_{os}$ as the level of the light emission signal, there are provided according to the invention the further steps of calculating, on the basis of a value $V_{ik}$ of a light reception signal obtained upon light reception based on light emission corresponding to the light emission signal having the predetermined level value $V_{os}$, an optimum value $V_{od}$ corresponding to the input value $V_{ik}$ in accordance with a $V_{ik}$ - $V_{od}$ characteristic table stored beforehand and representing a relationship between the value $V_{ik}$ as paper quality data and the optimum value $V_{od}$ of the light emission signal, setting the calculated optimum value $V_{od}$ as the level of the light emission signal to drive the light-emitting device, and calculating, on the basis of a value $V_{ik}$ of a corresponding light reception signal, a change value $V_{1-2}$ corresponding to the input value $V_{ik}$ in accordance with a $V_{ik}$ - $V_{1-2}$ characteristic table stored beforehand and representing a relationship between the value $V_{ik}$ as the paper quality data and a level change value $V_{1-2}$ of the light reception signal caused by overlapping of sheets to be fed when the optimum value $V_{od}$ is set as the level of the light emission signal, calculating a determination level $V_L$ in accordance with the following equation:

$$V_L = V_1 - V_{1-2} \cdot 1/2$$

where $V_1$ is the value of a light reception signal obtained when the optimum value $V_{od}$ is set as the level of a light emission signal, and detecting overlapping of sheets to be fed in accordance with the calculated determination level $V_L$.

## Brief Description of the Drawings

Fig. 1 is a block diagram showing an arrangement of an apparatus according to a first embodiment of the present invention;

Fig. 2 is a flow chart for explaining data registration processing executed by a CPU of the apparatus shown in Fig. 1;

Fig. 3 is a graph showing an optimum value $V_{od}$ of a control level $V_{out}$ experimentally obtained by using a value $V_{ik}$ as paper quality data;

Fig. 4 is a graph showing a change value $V_{1-2}$ of an output level $V_{in}$ experimentally obtained by using the value $V_{ik}$ as paper quality data;

Fig. 5 is a graph showing a relationship between a light emission amount and an output level, which is different for one sheet of paper and two sh ts of pap r;

## Detailed Description of the Preferred Embodiments

A sheet overlapping detecting method according to the present invention will be described in detail below.

Fig. 1 shows an arrangement of an apparatus according to an embodiment of the present invention. Referring to Fig. 1, reference numeral 1 denotes a light-emitting device; 2, a light-receiving device; 3, an amplifier for amplifying an output electrical signal (analog signal) corresponding to a received light amount supplied from the light-receiving device2; 4, an A/D converter for converting the amplified electrical signal supplied from the amplifier 3 into a digital signal and supplying the digital signal as a light reception signal having an output level $V_{in}$ to a microprocessor (to be referred to as a CPU hereinafter) 5; 6, a D/A converter for converting a light emission signal having a control level (digital signal) $V_{out}$ output from the CPU 5 into an analog signal; 7, an amplifier for amplifying the analog signal output from the D/A converter 6 to obtain a power signal and supplying the power signal to the light-emitting device 1; and 13, a sheet of paper to be printed.

The CPU 5 is connected to keys 8 for inputting a command by an operator, a detection timing generator 9 for generating a sheet detection timing, and a monitor 10 for acknowledging processing information of the CPU 5 to an operator. A central processing system is constituted by the CPU 5, a ROM 11 for storing programs for operating the CPU 5 and characteristic tables to be described later, and a RAM 12 for storing/editing various types of information.

The light-emitting device 1 and the light-receiving device 2 are arranged to oppose each other with a front guide of a feeding table of a press (not shown) therebetween as described above in the explanation of the conventional apparatus. The amplification factors (gains) of the amplifiers 3 and 7 can be arbitrarily adjusted.

Fig. 2 is a flow chart for explaining data registration processing to be executed by the CPU 5. The processing will be described below with reference to the flow chart shown in Fig. 2. That is, when an operator inputs an initial command of sheet overlapping detection processing, i.e., a "registered data initialization command" via the keys 8, the CPU 5 initializes data registered so far (step 101). When an operator feeds one she t of paper to the front guide, i.e., conveys the sheet 13 between the light-emitting device 1 and the light-receiving device 2 and inputs a "data registration start command" via the keys 8, the CPU 5 sets a

control level $V_{out}$ of a light emission signal as a predet rmined level value $V_{os}$ (st p 102). As a result, the light-emitting device 1 emits light in a light emission amount corresponding to the predetermined level value $V_{os}$.Thereafter, the CPU 5 calculates a time required before the light emission amount of the light emitted by the light-emitting device 1 is stabilized, waits until the calculated time elapses (step 103), and fetches a light reception signal having an output level $V_{in}$ corresponding to a received light amount of the light-receiving device 2 from the A/D converter 4 (step 104). A value $V_{ik}$ of the fetched output level $V_{in}$ is data indicating the paper quality of the sheet 13. The value $V_{ik}$ and an optimum value $V_{od}$ of the control level $V_{out}$ for maintaining the optimum value of the light emission amount with respect to the sheet 13 have a predetermined relationship. Fig. 3 is a graph showing a characteristic curve of the optimum value $V_{od}$ of the control level $V_{out}$ experimentally obtained by using the value ik as paper quality data (i.e., a $V_{ik}$ - $V_{od}$ characteristic table). This $V_{ik}$ - $V_{od}$ characteristic table is stored in the ROM 11, and the CPU 5 obtains and registers the optimum value $V_{od}$ of the control level $V_{out}$ corresponding to the fetched value $V_{ik}$ in accordance with the stored $V_{ik}$ - $V_{od}$ characteristic table (step 105).

The CPU 5 sets the registered optimum value $V_{od}$ as the control level $V_{out}$ (step 106) to change the light emission amount of the light emitted from the light-emitting device 1. Thereafter, the CPU 5 calculates a time required before the light emission amount of the light emitted from the light-emitting device 1 is stabilized, waits until the calculated time elapses (step 107), and fetches the output level $V_{in}$ corresponding to the received light amount of the light-receiving device 2 (step 108). A value $V_1$ of the fetched output level $V_{in}$ is obtained as the output level $V_{in}$ with respect to one sheet 13 obtained when the optimum value $V_{od}$ is set as the control level $V_{out}$. In this case, the value $V_{ik}$ obtained in step 104 and a change value $V_{1-2}$ of the output level $V_{in}$ (a difference between the output levels $V_{in}$ obtained for one sheet and two sheets) which changes in accordance with overlapping (two-sheet overlapping) of the sheets 13 when the optimum value $V_{od}$ is set as the control level $V_{out}$ have a predetermined relationship. Fig. 4 is a graph showing a characteristic curve of the change value $V_{1-2}$ of the output level $V_{in}$ experimentally obtained by using the value $V_{ik}$ as paper quality data (i.e., a $V_{ik}$ - $V_{1-2}$ characteristic table). This $V_{ik}$ - $V_{1-2}$ characteristic table is stored in the ROM 11, and th CPU 5 obtains the change value $V_{1-2}$ corresponding to the value $V_{ik}$ obtained in step 104 in accordance with the stored $V_{ik}$ - $V_{1-2}$ characteristic table and obtains and registers a determination level $V_L$ by the following relation (step 109):

$$V_L = V_1 - V_{1-2} \cdot 1/2$$

The optimum light emission amount and the optimum determination level with respect to the sheet 13 are determined by the above processing. By repetitively performing the above processing each time the paper quality of sheets of paper changes, the optimum light emission amount and the optimum determination level can be determined for sheets of paper having a wide range of paper quality to realize stable sheet overlapping detection with high precision. In addition, the optimum value $V_{od}$ of the control level $V_{out}$ is obtained in accordance with the $V_{ik}$ - $V_{od}$ characteristic table, and the change value $V_{1-2}$ is obtained in accordance with the $V_{ik}$ - $V_{1-2}$ characteristic table. Therefore, since the optimum light emission amount and the optimum determination level can be adjusted without depending on the skills of an operator, an adjustment operation can be largely simplified.

In the above description, the "data registration start command" is supplied to the CPU 5 via the keys 8. However, the "data registration start command" can be automatically supplied at a predetermined timing from the detection timing generator 9 during an operation of the press. In this case, since a sheet need not be manually conveyed to the front guide and the "data registration start command" need not be supplied via the keys 8, an operator need only input the "registered data initialization command", if necessary.

In the mass-production, a variation in characteristics of the light-emitting device 1 and the light-receiving device 2 between individual products is a problem. That is, a relationship obtained by the light-emitting device 1 and the light-receiving device 2 which are actually used is sometimes largely shifted from the relationships shown in Figs. 3 and 4, and this is a large unstable factor in the mass-production. Therefore, in order to maintain the relationship obtained by the light-emitting device 1 and the light-receiving device 2 constant, the system of the present invention additionally has a correction function (to be referred to as an ADJ function hereinafter). That is, when an operator inputs an "ADJ function start command" via the keys 8, the CPU shifts an operation mode from a normal overlapping detection mode to an ADJ function mode. In this ADJ function mode, the CPU 5 sets the predetermined level value $V_{os}$ as the control level $V_{out}$ and fetches the output level $V_{in}$ at a predetermined interval. The CPU 5 causes the monitor 10 to display information indicating whether the fetched output level $V_{in}$ falls within a predetermined range or is higher or low r than the range. Since an operator adjusts the gains of the

amplifiers 3 and 7 while monitoring the displayed value, th relationship obtained by the light-emitting device 1 and the light-receiving device 2 can be easily corrected to be constant, and overlapping detection can be performed more stably by this correction. Note that this adjustment need only be performed once upon installation of the apparatus.

As has been described above, according to the present invention, on the basis of the level value $V_{lk}$ of a light reception signal corresponding to the predetermined level value $V_{os}$ of a light emission signal, the optimum value $V_{od}$ and the change value $V_{1-2}$ are calculated in accordance with the $V_{lk}$ - $V_{od}$ characteristic table and the $V_{lk}$ - $V_{1-2}$ characteristic table, respectively, and the value $V_1$ of the light reception signal corresponding to the optimum value $V_{od}$ of the light emission signal is calculated, thereby calculating the determination level $V_L$ in accordance with ($V_1$ - $V_{1-2}$1/2). Therefore, since the optimum light emission amount and the optimum determination level can be determined with respect to sheets of paper having a wide range of paper quality, stable sheet overlapping detection can be performed with high precision. In addition, since the optimum light emission amount and the optimum determination level can be adjusted without depending on the skills of an operator, an adjustment operation can be largely simplified.

## Claims

1. A sheet overlapping detecting method in which light-emitting means (1) is driven in accordance with a light emission signal having a control level $V_{out}$ output from a data processing unit (5), light emitted from said light-emitting means is radiated in a direction of thickness of a sheet (13) to be fed, transmitted through the sheet (13) to be fed is received by light-receiving means (2), a light reception signal having an output level $V_{in}$ corresponding to a received light amount of said light-receiving means is input to said data processing unit 5, and overlapping of sheets to be fed is detected on the basis of the light reception signal, comprising the steps of:

   setting a predetermined level value $V_{os}$ as the level of the light emission signal, and characterised by the further steps of: calculating, on the basis of a value $V_{lk}$ of a light reception signal obtained upon light reception based on light emission corresponding to the light emission signal having the predetermined level valu $V_{os}$, an optimum value $V_{od}$ corresponding to the input value $V_{lk}$ in accordance with a $V_{lk}$ - $V_{od}$ characteristic table stored beforehand and representing a relationship between the value $V_{lk}$ as paper quality data and the optimum value $V_{od}$ of the light mission signal;

   setting the calculated optimum value $V_{od}$ as the level of the light emission signal to drive said light-emitting device, and calculating, on the basis of a value $V_{lk}$ of a corresponding light reception signal, a change value $V_{1-2}$ corresponding to the input value $V_{lk}$ in accordance with a $V_{lk}$ - $V_{1-2}$ characteristic table stored beforehand and representing a relationship between the value $V_{lk}$ as the paper quality data and a level change value $V_{1-2}$ of the light reception signal caused by overlapping of sheets to be fed when the optimum value $V_{od}$ is set as the level of the light emission signal;

   calculating a determination level $V_L$ in accordance with the following equation:

   $$V_L = V_1 - V_{1-2} \bullet 1/2$$

   where $V_1$ is the value of a light reception signal obtained when the optimum value $V_{od}$ is set as the level of a light emission signal; and

   detecting overlapping of sheets to be fed in accordance with the calculated determination level $V_L$.

2. A method according to claim 1, wherein said $V_{lk}$ - $V_{od}$ characteristic table and said $V_{lk}$ - $V_{1-2}$ characteristic table are stored in a ROM (11).

3. A method according to claim 1, wherein said data processing unit (5) comprises a microprocessor.

## Patentansprüche

1. Ein Verfahren zum Feststellen des Überlappens von Blättern, bei dem lichtemittierende Mittel (1) einem einen von einer Datenverarbeitungseinheit (5) ausgegebenen Steuerpegel $V_{out}$ umfassenden Lichtemissionssignal entsprechend betrieben werden, Licht, das von den lichtemittierenden Mitteln emittiert wird, in einer Richtung durch die Stärke eines zuzuführenden Blattes (13) ausgestrahlt, durch das zuzuführende Blatt (13) durchgelassen und von lichtempfangenden Mitteln (2) empfangen wird, ein Lichtempfangssignal mit einem einer empfangenen Lichtmenge der lichtempfangenden Mittel entsprechenden Ausgangspegel $V_{in}$ in die Datenverarbeitungseinheit (5) eingegeben wird, und das Überlappen von zuzuführenden Blättern auf Grundlage des Lichtempfangssignals festgestellt wird, wobei das Verfahren die Einstellung eines vorbestimmten Pegelwerts

$V_{os}$ als Pegel des Lichtemissionssignals umfaßt und durch folgende weit re Schritte gekennzeichnet ist:

Berechnen - und zwar auf Grundlage eines Wertes $V_{ik}$ eines Lichtempfangssignals, das beim Empfang von Licht aufgrund von Lichtausstrahlung entsprechend dem Lichtemissionssignal mit dem vorbestimmten Wert $V_{os}$ erhalten wird - eines Optimum-Wertes $V_{od}$, der dem Eingangswert $V_{ik}$ gemäß einer $V_{ik}$ - $V_{od}$-Charakteristik-Tabelle, die das Verhältnis zwischen dem Wert $V_{ik}$ als Papierqualitätsdaten und dem Optimum-Wert $V_{od}$ des Lichtemissionssignals darstellt und zwar zuvor gespeicherten ist;

Einstellen des berechneten Optimum-Wertes $V_{od}$ als den das lichtemittierende Gerät treibenden Pegel des Lichtemissionssignals, und

Berechnen - und zwar auf Grundlage eines Wertes $V_{ik}$ eines entsprechenden Lichtempfangssignals - eines Änderungswertes $V_{1-2}$, der dem Eingangswert $V_{ik}$ gemäß einer $V_{ik}$ - $V_{1-2}$ -Charakteristik-Tabelle entspricht, die zuvor gespeichert ist und das Verhältnis zwischen dem Wert $V_{ik}$ als die Papierqualitätsdaten und einem durch das Überlappen von zwei zuzuführenden Blättern, wenn der Optimum-Wert $V_{od}$ als der Pegel des Lichtemissionssignals eingestellt ist, verursachten Pegeländerungswert $V_{1-2}$ des Lichtempfangssignal wiedergibt;

Berechnen eines Bestimmungspegels $V_L$ gemäß folgender Gleichung:

$$V_L = V_1 - V_{1-2}.1/2,$$

worin $V_1$ der Wert eines Lichtemfangssignals ist, das erhalten wird, wenn der Optimum-Wert $V_{od}$ als Pegel eines Lichtemissionssignals eingestellt wird; und

Feststellen des Überlappens von zuzuführenden Blättern gemäß dem berechneten Bestimmungspegel $V_L$.

2. Ein Verfahren nach Anspruch 1, bei dem die $V_{ik}$ - $V_{od}$-Charakteristik-Tabelle und die $V_{ik}$ - $V_{1-2}$-Charakteristik-Tabelle in einem ROM (11) gespeichert werden.

3. Ein Verfahren nach Anspruch 1, bei dem die Datenverarbeitungseinheit (5) einen Mikroprozessor umfaßt.

## Revendicati ns

1. Procédé de détection de chevauchement de feuill s, dans l quel des moyens d'émission de lumière (1) sont commandés en conformité avec un signal d'émission de lumière présentant un signal de sortie de niveau de commande $V_{out}$ provenant d'une unité (5) de traitement de données, dans lequel la lumière émise provenant desdits moyens émetteurs de lumière est rayonnée dans la direction de l'épaisseur d'une feuille (13) devant être approvisionnée, est transmise à travers la feuille (13) devant être approvisionnée et est reçue par des moyens récepteurs de lumière (2), dans lequel un signal de réception de lumière présentant un niveau de sortie $V_{in}$ correspondant à la quantité de lumière reçue desdits moyens récepteurs de lumière, est entré dans ladite unité de traitement de données (5), et dans lequel le chevauchement des feuilles devant être approvisionnées est détecté sur la base du signal de réception de lumière, ledit procédé comprenant les étapes consistant à :

ajuster une valeur $V_{os}$ d'un niveau prédéterminé en tant que niveau du signal d'émission de lumière, ledit procédé étant caractérisé par les étapes suivantes consistant à :

calculer, sur la base d'une valeur $V_{ik}$ d'un signal de réception de lumière obtenu à partir de la réception de lumière fondée sur l'émission de lumière correspondant au signal d'émission de lumière présentant la valeur de niveau prédéterminé $V_{os}$, une valeur optimale $V_{od}$ correspondant à la valeur d'entrée $V_{ik}$ en conformité avec une table de valeurs caractéristiques $V_{ik}$-$V_{od}$ emmagasinée préalablement et représentant une relation entre la valeur $V_{ik}$ en tant que donnée de qualité de papier et la valeur optimale $V_{od}$ du signal d'émission de lumière;

ajuster la valeur optimale calculée $V_{od}$ en tant que niveau du signal d'émission de lumière pour commander ledit dispositif d'émission de lumière; et calculer, sur la base d'une valeur $V_{ik}$ d'un signal de réception de lumière correspondant, une valeur de modification $V_{1-2}$ correspondant à la valeur entrée $V_{ik}$ en conformité avec une table de valeurs caractéristiques $V_{ik}$-$V_{1-2}$ emmagasinée préalablement et représentant une relation entre la valeur $V_{ik}$ en tant que donnée de qualité de papier et la valeur de modification de niveau $V_{1-2}$ du signal de réception de lumière provoquée par le chevauchement de feuilles qui doivent être approvisionnées lorsque la valeur optimale $V_{od}$ est ajustée en tant que niveau du signal d'émission de lumière;

calculer un niveau de détermination $V_L$ en conformité avec l'équation suivante :

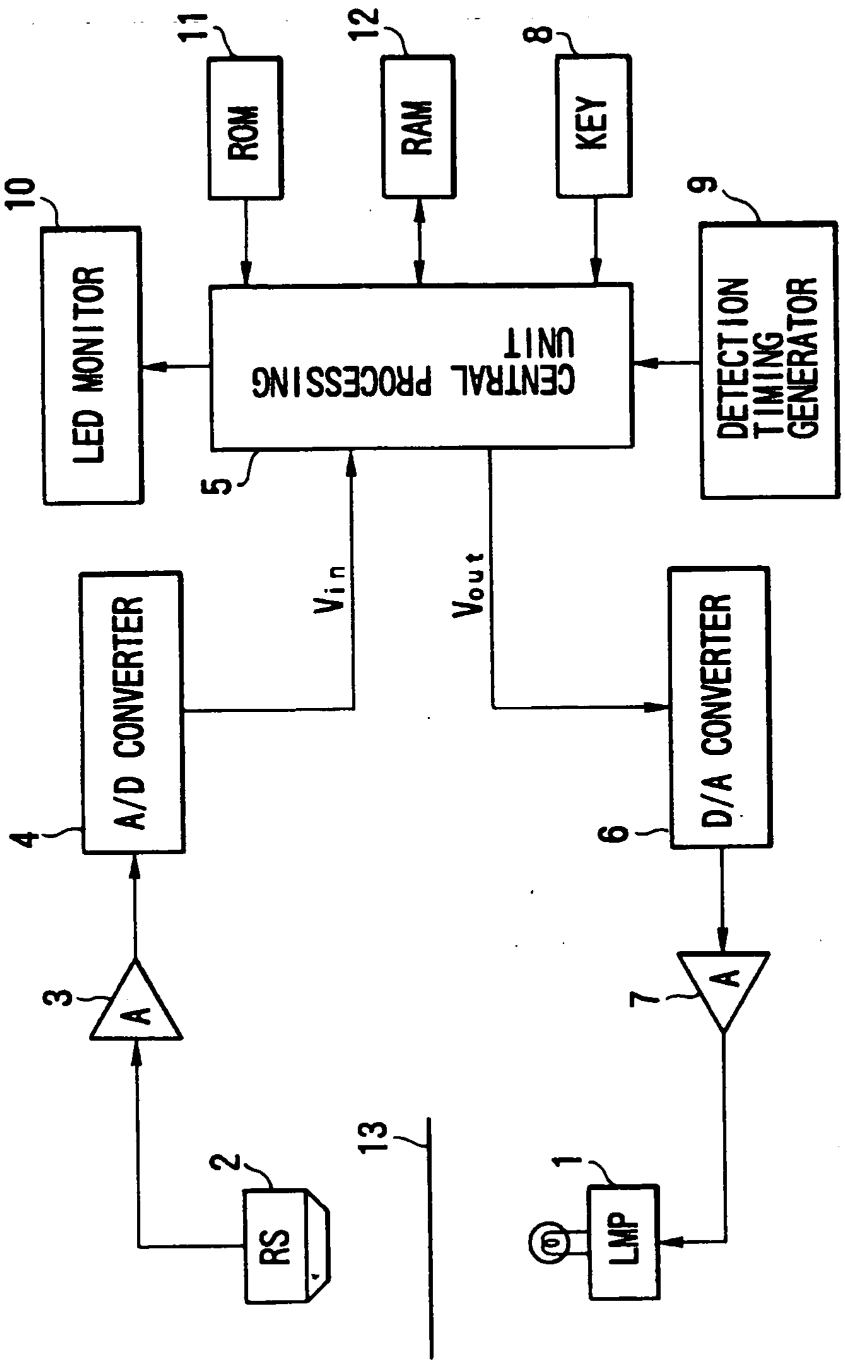
$$V_L = V_1 - V_{1-2}.1/2$$

dans laquelle $V_1$ est la valeur du signal de réception de lumière obtenu lorsqu la valeur optimale $V_{od}$ est ajustée en tant que niveau du signal d'émission de lumière; et

détecter le chevauchement des feuilles devant être approvisionnées en conformité avec le niveau de détermination calculé $V_L$.

2. Procédé selon la revendication 1, dans lequel ladite table des valeurs caractéristiques $V_{lk}$-$V_{od}$ et ladite table des valeurs caractéristiques $V_{lk}$-$V_{1-2}$ sont emmagasinées dans une mémoire morte ROM (11).

3. Procédé selon la revendication 1, dans lequel ladite unité (5) de traitement des données comprend un microprocesseur.



10
LED MONITOR
11
ROM
12
RAM
8
KEY
9
DETECTION TIMING GENERATOR
CENTRAL PROCESSING UNIT
5
4
A/D CONVERTER
$V_{in}$
$V_{out}$
6
D/A CONVERTER
3
A
7
A
2
RS
13
1
LMP


FIG.1

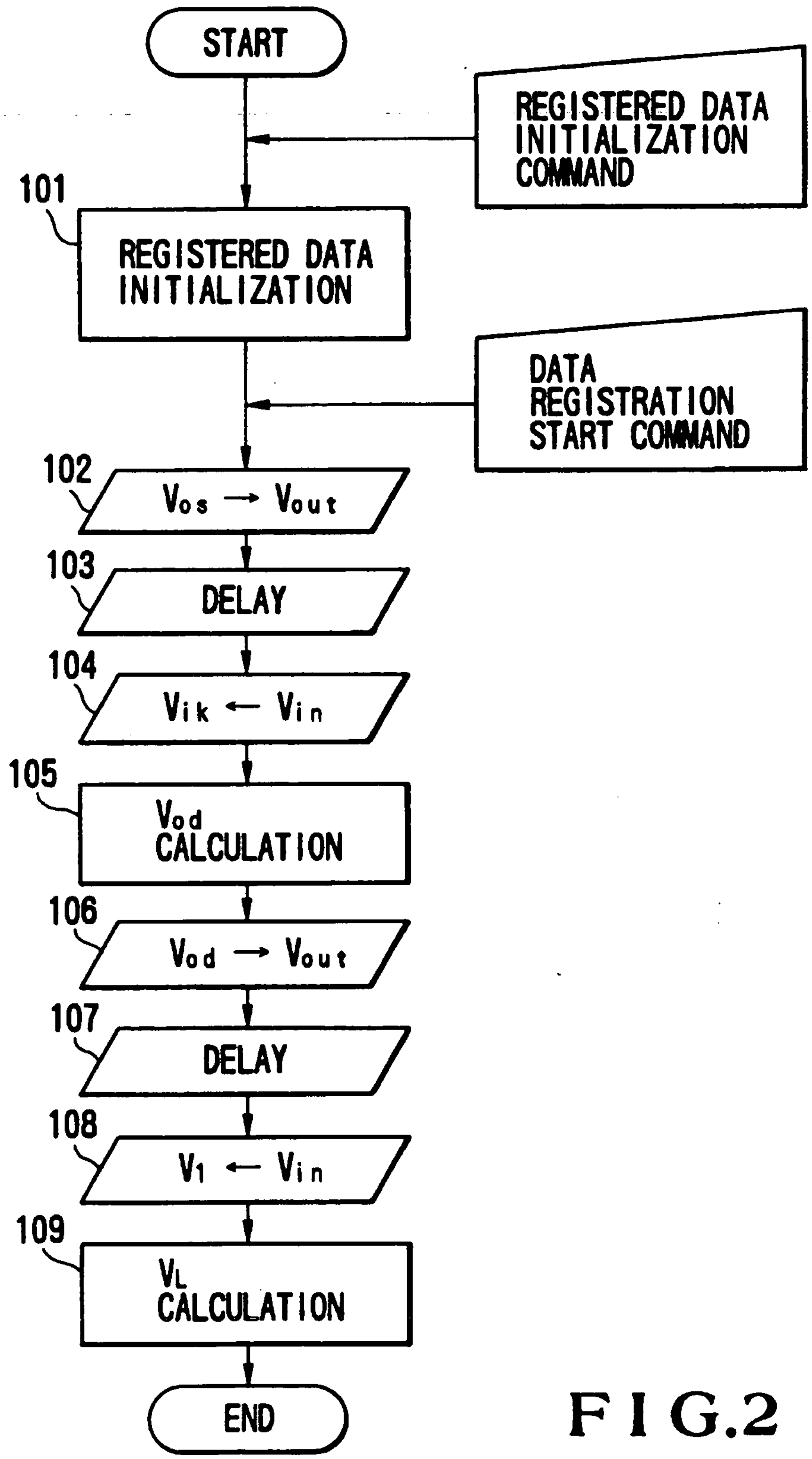

START
REGISTERED DATA INITIALIZATION COMMAND
101
REGISTERED DATA INITIALIZATION
DATA REGISTRATION START COMMAND
102
$V_{os} \rightarrow V_{out}$
103
DELAY
104
$V_{ik} \leftarrow V_{in}$
105
$V_{od}$ CALCULATION
106
$V_{od} \rightarrow V_{out}$
107
DELAY
108
$V_1 \leftarrow V_{in}$
109
$V_L$ CALCULATION
END

FIG.2

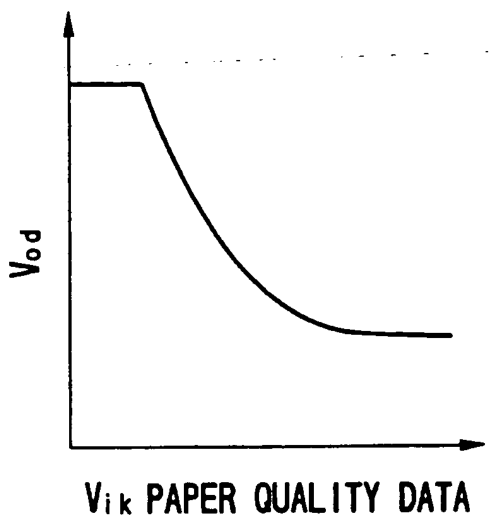



FIG.3

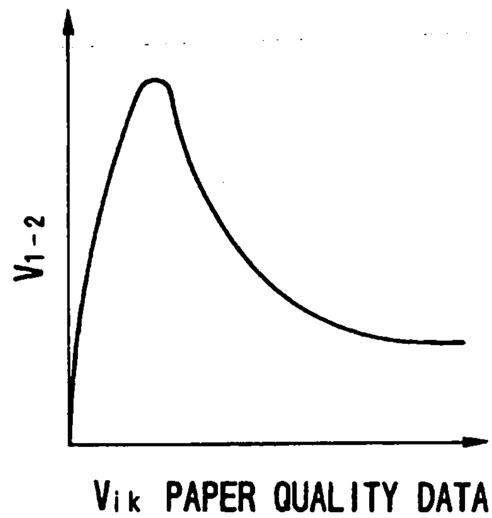



FIG.4

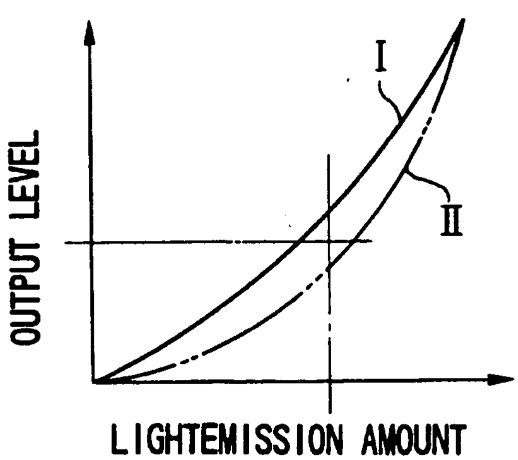



FIG.5